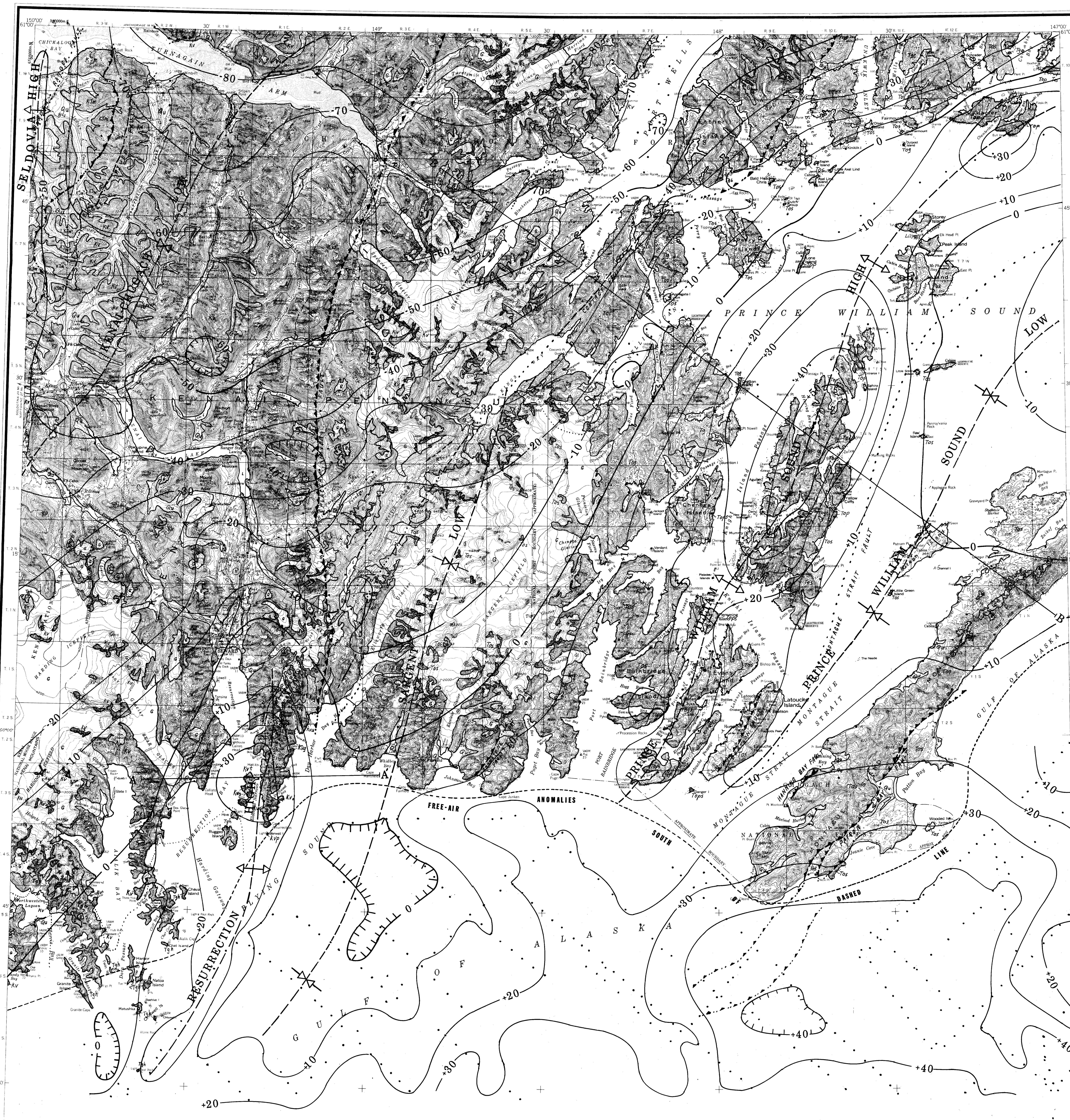

Base from U.S. Geological Survey, 1953

Geology modified from Tysdal and Case (in press)

CORRELATION OF MAP UNITS

Map units	Epoch	Period
L, G, Qu	Holocene	QUATERNARY
Tg	Oligocene	TERTIARY
Tgc	Eocene(?)	TERTIARY
Tgh	Eocene	TERTIARY
Tos, Tog, Top, Tod, Togs, Tops, Togb	Lower Eocene(?) and Paleocene	TERTIARY
Tgb	Oligocene(?) Eocene(?), or Paleocene(?)	TERTIARY
Kv, Kvs, Kvp, Kvd, Kvt, Kvg, Kvu	Upper Cretaceous	CRETACEOUS
KJm	Cretaceous and(or) upper Jurassic	CRETACEOUS AND (OR) JURASSIC

DESCRIPTION OF MAP UNITS

- L — LAKE
- G — GLACIER
- Qu — UNCONSOLIDATED SEDIMENTARY DEPOSITS, UNDIVIDED (Holocene)
- Tg — GRANITE AND GRANODIORITE (Oligocene)--Unfoliated granite and granodiorite
- Tgc — GRANITE (Eocene(?))--Muscovite-bearing granite of Cedar Bay area
- Tgb — GABBRO (Oligocene(?), Eocene(?), or Paleocene(?))--Olivine-bearing plutonic rocks
- Tgh — GRANITE OF HARDING ICEFIELD REGION (Eocene)--Foliated granite

ORCA GROUP (lower Eocene(?) and Paleocene)--Divided into:

- Tos — SEDIMENTARY ROCKS, UNDIVIDED--Flysch of sandstone and siltstone
- Tog — GREENSTONE, UNDIVIDED--Basaltic rocks not distinguished as to pillows, dikes, or tuffs
- Top — PILLOW BASALT--Submarine extrusive basalt
- Tod — SHEETED BASALT DIKES--Sequence composed almost wholly of dikes
- Togs — GREENSTONE AND SEDIMENTARY ROCKS--Basalt sills and dikes intruding flysch
- Tops — PILLOW BASALT AND SEDIMENTARY ROCKS--Interbedded pillow basalt and flysch
- Togb — GABBRO--Small plutons and locally coarse-grained dikes

VALDEZ GROUP (Upper Cretaceous)--Divided into:

- Kv — SEDIMENTARY ROCKS, UNDIVIDED--Flysch of sandstone and siltstone, in part metamorphosed to slate and phyllite
- Kvs — SCHIST--Sandstone, siltstone, and some tuffs metamorphosed to biotite grade of greenschist facies
- Kvp — PILLOW BASALT--Submarine extrusive basalt
- Kvd — SHEETED BASALT DIKES--Sequence composed almost wholly of dikes
- Kvt — TUFF--Aquagene tuff interbedded with flysch
- Kvg — GABBRO--Large pluton that intrudes sheeted dikes and flysch
- Kvu — ULTRAMAFIC ROCKS--Small tabular bodies of serpentinized dunite

McHUGH COMPLEX (Cretaceous and(or) Jurassic)

- KJm — McHUGH COMPLEX--Weakly metamorphosed clastic and volcanic rocks; in large part is a melange

EXPLANATION FOR MAP SYMBOLS

Contact--Dashed where approximately located; dotted where concealed

High-angle fault--Dotted where concealed

Thrust fault--Dotted where concealed. Sawteeth on upper plate

Gravity station

Approximate axis of relative positive anomaly

Approximate axis of relative negative anomaly

-50

Gravity anomaly contour - Interval 10 milligals. Hachures indicate closed relative negative anomaly. Contours are free-air anomalies in offshore area in southern part of map

Simple Bouguer anomalies computed for a reduction density of 2.67 g/cm^3. Gravity datum is from IGSN 1971, and the reduction ellipsoid from the 1967 Geodetic Reference System

GEOLOGIC INTERPRETATION OF THE GRAVITY ANOMALY MAP OF THE SEWARD AND BLYING SOUND QUADRANGLES, ALASKA

Introduction

For more than 20 years, gravity surveys have been conducted in the vicinity of Prince William Sound, the epicentral region of the great Alaska earthquake of March 27, 1964. Some of the major regional gravity anomalies were outlined by Thiel, Ostenso, Bonini, and Woollard (1958, 1959) and Woollard, Ostenso, Thiel, and Bonini (1960), and additional anomalies were defined by pre- and post-earthquake gravity studies reported by Barnes and Allen (1965) and Case, Barnes, Plafker, and Robbins (1966). Another gravity anomaly map was prepared by personnel of the U.S. Coast and Geodetic Survey (now the National Oceanic and Atmospheric Administration) (Wood, 1966, p. 131; Rice, 1969, p. 5-20). Anomalies shown by Rice (1969) are broadly similar to those shown by Case, Barnes, Plafker, and Robbins (1966); Rice's interpretation concerned mainly gravity changes related to the earthquake, and the data were not interpreted in terms of regional geology. New gravity stations were established in 1976 as part of the mineral resource appraisal of the Seward and Blying Sound quadrangles. This report incorporates the new data obtained in 1976, reinterprets some anomalies previously discussed by Case, Barnes, Plafker, and Robbins (1966), and interprets other anomalies not previously discussed. Descriptions of the major rock units and structural features are found in the companion report by Tysdal and Case (in press). An interpretation of the aeromagnetic map of the region has been prepared by Case, Tysdal, Hillhouse, and Gromme (1979).

Most of the gravity measurements were made with LaCoste & Romberg ...

... monly 2-10 mgal, or more, depending on details of terrain in the neighborhood of the station. From a few trial terrain corrections, we estimate that complete Bouguer anomalies for most of the map would be 2-10 mgal more positive than values shown on this simple Bouguer anomaly map. Small, apparent, closed anomalies or small, abrupt flexures in the contours on the simple Bouguer anomaly map may well represent effects of terrain, elevation errors, positional errors, or reading errors--or some combination of these--and should be ignored for purposes of regional geologic interpretation.

Densities

Densities have been measured for a large number of rock specimens from the Prince William Sound region. Most of the samples were collected in the Seward and Blying Sound quadrangles, but some were collected from the Valdez and Cordova quadrangles to the east. The table below summarizes data on all samples as compared with data reported in 1966 (Case and others, 1966, table 1, p. C5):

Rock unit	No. of specimens	Densities Minimum	Densities Maximum	Average	No. of specimens (1966)	Average 1966
Granitic rocks	25	2.55	2.77	2.65	8	2.62
Sedimentary and metasedimentary rocks of the Orca and Valdez Groups	106	2.55	2.77	2.71	26	2.69
Mafic volcanic rocks of the Orca and Valdez Groups	97	2.57	3.07	2.87	8	2.87

...

In the southeastern part of the area, a large regional gravity high having values of around +40 mgal occurs just south of Montague Island. This high partly coincides with a major northwest-trending magnetic high (Case and others, 1979) and is probably caused by a mafic or ultramafic mass that is buried 5-10 km or more below the surface. The magnetic high extends beyond the gravity high, both to the northwest and to the southeast, and suggests that the main mass causing the anomalies is ultramafic rock that has a variable degree of serpentinization along strike. Where magnetic and gravity highs coincide, as south of Montague Island, the mass is probably relatively unserpentinized. Where no special gravity highs are present, as southwest of Montague Island, the serpentinization is probably greater, leading to reduced density of the mass.

Some Regional Gravity Lows

Kenai-Chugach low--In the northwestern part of the map area, a major regional gravity low trends northeast along the Kenai Mountains and across Turnagain Arm. This low is a prolongation of the long regional low in southern Alaska that occurs over the Chugach Mountains to the north and ...

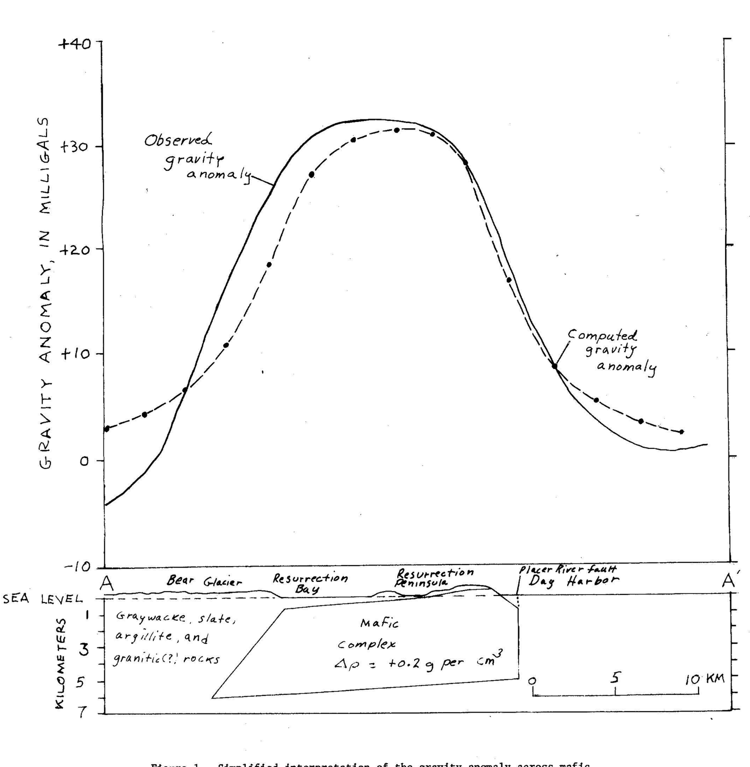

Figure 1. Simplified interpretation of the gravity anomaly across mafic complex of the Resurrection high. Δρ is the density contrast.

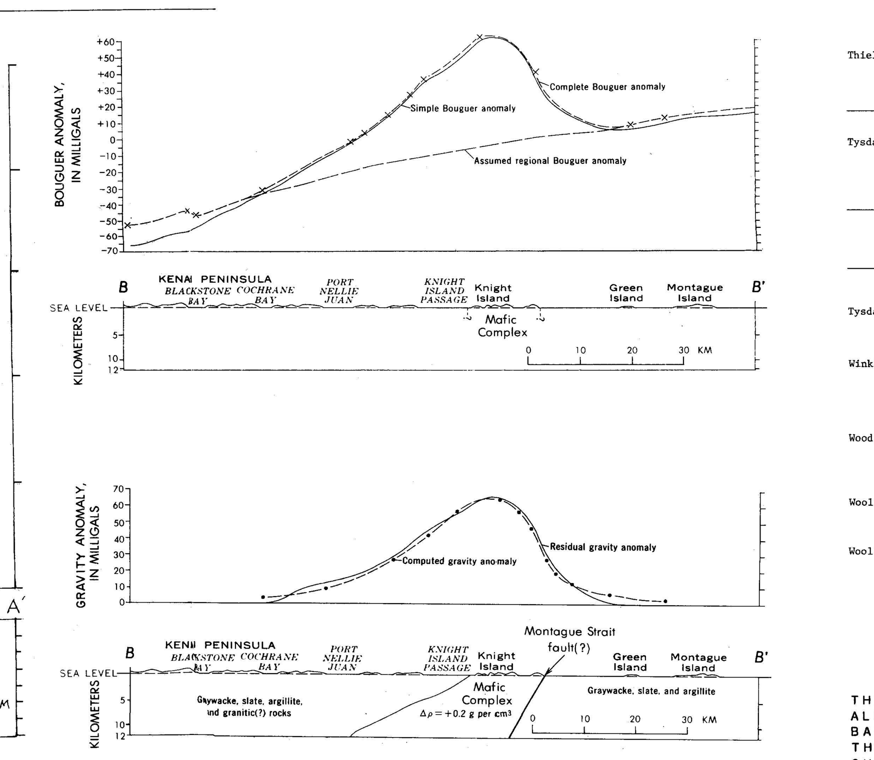

Figure 2. Gravity anomaly profiles and interpretation of the gravity anomaly over Knight Island. Δρ is the density contrast. Modified from Case, Barnes, Plafker, and Robbins (1966).

... Survey in Alaska, Accomplishments during 1976: U.S. Geological Survey Circular 751-B, p. B44-B45.

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Woollard, G. P., and Strange, W. E., 1962, Gravity anomalies and crust of the Earth in the Pacific basin, in MacDonald, G. A., and Kuno, Hisashi, eds., The crust of the Pacific basin: American Geophysical Union Geophysical Monograph 6, p. 60-80.

QUADRANGLE LOCATION

SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
DATUM IS MEAN SEA LEVEL

LOCATION INDEX

	150°		147°	
61°	TYONEK	ANCHORAGE	VALDEZ	61°
60°	KENAI	SEWARD	CORDOVA	60°
	SELDOVIA	BLYING SOUND	MIDDLETON ISLAND	
	150°		147°	

GEOLOGIC INTERPRETATION OF THE GRAVITY ANOMALY MAP OF THE SEWARD AND BLYING SOUND QUADRANGLES, ALASKA

BY

J.E. CASE, ROBERT SIKORA, R.G. TYSDAL, DAVID F. BARNES, AND ROBERT MORIN

1979

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